Volume 2

Chapter 22 Urban Water Use Efficiency

With urban water use efficiency, an increase in population does not necessarily result in a proportionate increase in urban water use. (J. Saare-Edmonds/ DWR photo)

Chapter 22 *Urban Water Use Efficiency*

Urban water use efficiency involves technological or behavioral improvements in indoor and outdoor residential, commercial, industrial and institutional water use that lower demand, lower per capita water use, and result in benefits to water supply, water quality, and the environment.

Urban Water Use Efficiency Efforts in California

In 2000, cities and suburbs used about 8.7 million acre-feet of water. Californians have made great progress on urban water use efficiency over the past few decades. As has been demonstrated in various regions of the state, an increase in population does not necessarily result in a proportionate increase in urban water use. For example, the Los Angeles Department of Water and Power reports in their Urban Water Management Plan Update 2002-2003 that "water conservation continues to play an important part in keeping the city's water use equivalent to levels seen 20 years ago." While some other regions of the State cannot claim such progress, this report indicates that indeed something is working well in the field of water use efficiency.

Credit for these improvements can be given in part to the implementation of water use efficiency practices that have been institutionalized through the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding (MOU). This involves the active participation and united effort of urban water agencies, environmental interests, and the business community. They come together to plan, implement, and track a defined set of urban Best Management Practices (BMPs See Box 22-1). As of 2003 there were 309 signatories to the Urban MOU, representing 80 percent of all the urban water supplied in California.

One example of the results of the CUWCC's member agency implementation efforts is that nearly 2.5 million water efficiency toilets have been retrofitted statewide in the past 13 years. The total number of toilets installed before 1992 that still need to be replaced is about 10 million. Water conservation has become a way of life for Californians, most of whom have easy and affordable access to a wide array of off-the-shelf water efficient plumbing fixtures, washing machines, landscape irrigation systems, and water-thrifty plants at their local home improvement stores, hardware stores, and nurseries.

Box 22-1 Urban BMPs

BMP 1: Residential Survey Programs
BMP 2: Residential Plumbing Retrofit
BMP 3: System Water Audits
BMP 4: Metering with Commodity Rates
BMP 5 Large Landscape Conservation
BMP 6: High Efficiency Clothes Washers
BMP 7: Public Information Programs
BMP 8: School Education Programs
BMP 9: Commercial Industrial Institutional
BMP 10: Wholesaler Agency Assistance Programs
BMP 11: Conservation Pricing
BMP 12: Conservation Coordinator
BMP 13: Water Waste Prohibitions
BMP 14: Residential Ultra Low Flush Toilet Replacement Programs

While the council is considering more BMPs, there are other activities that could contribute toward improved water use efficiency, including new methods and technologies that can be expected to significantly increase conservation potential. The Irvine Ranch Water District is experimenting with "ET Controllers" – weather-controlled irrigation systems and installed controllers at 40 homes. Consumption dropped by 17 percent and runoff was cut in half. The 1999 American Water Works Foundation Research Foundation "Residential End Uses of Water" study found that approximately 60 percent of residential water comes from outdoor uses.

Assembly Bill 2717, authored by Assemblyman John Laird and signed by Governor Arnold Schwarzenegger in 2004, asked the CUWCC to convene a Landscape Task Force with representatives from water suppliers, environmental groups, government agencies, and the landscape and building industries to evaluate landscape water use efficiency and make recommendations for improvements. The Landscape Task Force is currently evaluating in great detail the potential for water savings for both new and existing development. The recommendations of the Task Force may lead to significant improvements in landscape irrigation through new Model Landscape Ordinance policies, new technologies, changes in rate structures, and new legislation (See Box 22-2). The Task Force will finish its work and submit a final report to the California Legislature and governor by December 31, 2005.

Potential Benefits of Urban Water Use Efficiency

The primary benefit of improving water use efficiency is the lowering of demand and the ability to cost-effectively stretch existing water supplies. Once viewed and invoked primarily as a temporary source of water supply in response to drought or emergency water shortage situations, water use efficiency and conservation approaches have become a viable long-term supply option, saving considerable capital and operating costs for utilities and consumers, avoiding environmental degradation, and creating multiple benefits. Reduced water demands will free up water in normal and wet years. Saved water can be carried over to another time if a supplier has surface or groundwater storage, or stores water by agreement with an agency that maintains a groundwater bank and returns it for use during drought years. Translating water use efficiency savings into specific water supply reliability benefits will depend on the water system involved, the level of savings, and the variations in water savings from one year to the next as well as throughout the year.

The CALFED Record of Decision (ROD) estimated that applied water savings of existing urban water use efficiency efforts would range between 0.8 million and 1 million acre-feet per year by 2030 (CALFED Record of Decision, 2000). A recent state-sponsored study (Pacific Institute's "Waste Not, Want

Box 22-2 Draft Recommendation from Landscape Task Force

- Urban water suppliers (wholesalers and retailers) should adopt water conserving rate structures as defined by the Task Force
- Reduce the ET Adjustment Factor in the Model Ordinance and review the ET Adjustment Factor every ten years for possible further reduction.
- Enforce and monitor compliance with local ordinances and the state Model Ordinance including an enforcement mechanism to insure effective irrigation system installation and efficiency.
- Require dedicated landscape meters.
- Promote the use of recycled water in urban landscapes.
- Require that local ordinances be at least as effective as the State Model Ordinance.
- Increase the public's awareness of the importance of landscape water use efficiency and inspire them to action.
- Require Smart Controllers.
- Adopt and enforce statewide prohibitions on overspray and runoff.
- Provide training and certification opportunities to landscape and irrigation professionals.
- Support upgrading the California Irrigation Management Information System (CIMIS) Program.
- Adopt performance standards for irrigation equipment.

Table 22-1 CBDA Estimates of 2030 urban conservation savings potential (demand reduction)						
Projection Level	Assumed Local Agency Investment	Assumed CALFED Grant Funding	(Demand Reduction by Category) 1,000 Acre-Feet Per Year			
			Required by Code	Local Agency Cost Effective	Grant Funded	Total Annual Potential
1	Historic Rate	Prop. 50 only	970	172	11	1,153
2	All Locally cost-effective	Prop. 50 only	970	881	11	1,862
3	Historic Rate mil./yr.	Prop. 50 + $15	970	172	257	1,399
4	All Locally cost-effective	Prop. 50 + $15 mil./yr.	970	881	257	2,108
5	All Locally cost-effective	Prop. 50 + $40 mil./ yr.(2005-2014); $10 mil./yr. (2015-2030)	970	881	224	2,075
6[1]	N/A	N/A	N/A	N/A	N/A	3,096

[1]Projection 6 represents the technical potential of the urban conservation measures evaluated by CBDA. It assumes 100% adoption statewide of these measures using existing technologies and provides a reference point for the other five projection levels.

Not") indicated potential savings of 2 million to 2.3 million acre-feet per year from existing urban conservation technologies and practices.

The California Bay Delta Authority (CBDA) sponsored a study of urban water conservation potential as part of its comprehensive review of the Water Use Efficiency Element of the CALFED Bay-Delta Program. This study evaluated urban water savings potential from three sources: (1) operation of efficiency codes that require certain water using appliances and fixtures to meet specified levels of efficiency; (2) local water agency implementation of urban conservation "Best Management Practices" (BMPs) specified in the Memorandum of Understanding Regarding Urban Water Conservation in California (Urban MOU) as well as other locally cost-effective conservation measures; and (3) additional urban conservation measures co-funded through CALFED Agency grant programs.

Estimates of urban savings potential were developed for six different projections. These projections employed different assumptions about local water agency implementation of conservation measures and funding levels for CALFED Agency grant programs. Two different levels of local water agency implementation of conservation measures were considered. The first level assumed implementation of BMPs would occur at the average rate of implementation observed during the first 13 years of the Urban MOU. The second level assumed that local water agencies would implement all BMPs and other conservation measures that were locally cost-effective from the perspective of the implementing agency. CALFED Agency grant program funding was evaluated at three levels. The first level assumed that grant program funding would consist only of remaining Proposition 50 funds available for urban conservation implementation. The second level assumed $15 million per year of funding for urban conservation implementation grants. The third level assumed $40 million per year of funding for the period 2005-2014 and $10 million per year for the period 2015-2030. These funding levels were selected to bracket the range of funding deemed probable at the time the study was undertaken. The sixth projection measured the water savings potential of the conservation measures under evaluation assuming 100% adoption and existing technologies. This last projection served as a reference point from which to evaluate the other five.

The CBDA estimates of 2030 urban conservation potential for the six projections are shown in Table 22-1. The estimates show the reduction in annual applied urban water use expected from each savings source as well as the total amount annual of savings. The technical potential, shown by projec-

Table 22-2 2030 Annual water savings potential by CBDA projections: recoverable and irrecoverable flows

Projection Level	Water Savings Potential 1,000 Acre-Feet Per Year		
	Irrecoverable Flow	Recoverable Flow	Total Savings Potential
1	729	423	1,153
2	1,285	575	1,862
3	818	578	1,399
4	1,375	729	2,108
5	1,368	702	2,075
6	1,980	1,110	3,096

tion 6, is about 3.1 million acre-feet per year. Advances in water-saving technology over the next 25 years, which the CBDA analysis did not evaluate, potentially could push savings beyond the levels shown in Table 22-1.

Total annual savings potential for projections 1 through 5 ranges between 1.2 million and 2.1 million acre-feet per year, or about 40% to 70% of technical potential. Water savings from efficiency codes, which include metering of currently unmetered connections, are significant, accounting for about 45% to 85% of total savings shown for projections 1 through 5. Water savings from local agency implementation are sharply affected by the assumed local investment. Potential savings are approximately five times greater if agencies are assumed to invest in all locally cost-effective measures than if they are assumed to invest at the historic rate of BMP implementation. Analysis results also show that continuing grant programs beyond Proposition 50 would approximately reduce water demand between 200,000 and 250,000 acre-feet per year by 2030.

Realization of a greater proportion of technical potential than shown by projections 1 through 5 would require higher rates of local and state/federal investment in urban conservation than considered by the CBDA analysis. Increasing BMP coverage requirements and higher levels of state/federal investment could allow the state to realize a greater amount of technical potential. However, achieving the technical potential savings may not be economical because of diminishing returns on investments.

The estimates in Table 22-1 represent changes in applied urban water use. This reduction in applied use includes both recoverable and irrecoverable flows. Recoverable flow is the portion of applied water that would return to a usable surface or groundwater body, making it available for reuse. Irrecoverable flow is the portion of applied water that would evaporate or return to an unusable surface or groundwater body and would not be available for reuse. Table 22-2 shows the annual recoverable and irrecoverable flows for the six projection levels.

Reducing both recoverable and irrecoverable flows, or urban applied water, through conservation can benefit urban water users. In either case, costs associated with water development, transmission, treatment, storage, distribution, and disposal can be avoided, which can benefit urban ratepayers. Reducing both types of flow may also result in increased stream flows and water quality benefits. Reducing irrecoverable flows through conservation has the added benefit of increasing the amount of developed water available for human uses at no added cost to other users or the environment.

Realizing the conservation potential shown in Table 22-1 offers water agencies immediate and longer-term benefits in the form of avoided costs of new supply construction, the cost of distribution systems, and the avoided costs of water-supply treatment and wastewater treatment plant permitting, construction and operation. Energy costs, which are a significant component of water costs, are avoided as well, both by the agency and the customer. The California Energy Commission estimates that nearly one-fifth of the state's energy use is associated with water development and use. Urban water conservation can help stretch the state's energy supplies as well as its water resources. Other benefits of urban water use efficiency include better water quality and more water in streams and rivers by allowing more flows to remain there. The timing of such additional flow is often critical to maintenance of endangered habitats. Water use efficiency can also reduce peak demand, curb runoff from landscape irrigation, and reduce green waste caused by inefficient watering of landscape.

Table 22-3 Statewide average unit cost of water savings by CBDA projection (2004 dollars)		
Projection Level	**Assumed Local Agency Investment**	**Average Unit Cost of Water Savings Per Acre-Foot**
1	Historic Rate	$522
2	Locally cost-effective	$223
3	Historic Rate	$395
4	Locally cost-effective	$227
5	Locally cost-effective	$233
6	A unit cost for projection 6 was not developed by CBDA because of uncertainty about how implementation costs would change as measure adoption rates approached 100%.	

One way to assess the financial benefits of a conservation measure is to compare the cost of producing an acre-foot of water savings from this measure to the cost of acquiring one more acre-foot of supply. This approach acknowledges that there are essentially two, and often compatible, approaches water agencies can use to meet their water demand. They can increase supplies and lower demands. Ratepayers benefit when water agencies use an integrated resource planning (IRP) approach to invest in the mix of supply- and demand-management strategies capable of meeting agreed-to resource management objectives with the lowest overall cost and impacts.

Potential Costs of Urban Water Use Efficiency

The average cost (in 2004 dollars) to realize an acre-foot of water savings for CBDA projections 1 through 5 are shown in Table 22-3. Costs range from $223 per acre-foot to $522 per acre-foot. The assumed local investment has a significant impact on the average costs. The average costs for projections that assume water agencies invest in all locally cost-effective conservation measures are approximately 40% to 60% lower than the other projections. It is important to note that the cost estimates in Table 22-3 are statewide averages and results for individual regions or water agencies could vary significantly.

Conservation's role in urban water management depends on a variety of regional and local considerations that are best addressed through an integrated resources planning framework. The unit costs in Table 22-3 suggest, however, that for most urban areas conservation will likely become an increasingly important part of their water resource management. The unit costs in Table 22-3 are currently lower than other urban supply options such as recycling, desalination, or new surface water development. The State Recycled Water Task Force, for example, estimated that California could achieve the Task Force's recycled water objectives at an average cost of $600 per acre-foot. A similar task force examining ocean desalination estimated average costs $661 to $834 per acre-foot, not inclusive of cost of delivery to the customer. Because conservation investments generally reduce customer end uses of water, the average costs shown in Table 22-3 are equivalent to a cost to deliver treated water to the customer tap.

The Record of Decision for the CALFED Bay Delta Program assumed that the average cost of urban conservation measures would be between $150 and $450 per acre-foot. CBDA's analysis of urban conservation potential suggests somewhat higher average costs, ranging, when rounded, between $220 and $530 per acre-foot. Both estimates indicate that investment in urban conservation can be a very cost-effective strategy for addressing growing urban demand for water.

Table 22-4 presents CBDA estimates of annual investment over the period 2005-2030 needed to realize the conservation savings shown for projections 1 through 5 in Table 22-1. Annual investment costs range between $99 million and $236 million. This investment is of three types: (1) direct investment by water agencies in locally cost-effective conservation measures; (2) investment by CALFED Agencies through grants; and (3) additional investment by water agencies leveraged by grants from CALFED Agencies. Approximately 60% to 90% of the annual investment costs shown in Table 22-4 are of the first type. The remaining 10% to 40% of investment comes from grants and grant-leveraged local investment.

Table 22-4 CBDA estimates of 2030 urban conservation savings potential (demand reduction)

Projection Level	Local Agency Investment Assumption	CALFED Grant Funding Assumption	Annual Investment Cost ($ Millions per year)			
			Local Direct Investment	Grants	Grant-leveraged Local Investment	Annual Investment
1	Historic Rate	Prop. 50 only	95	3	1	99
2	Locally cost-effective	Prop. 50 only	188	3	1	192
3	Historic Rate	Prop. 50 + $15 mil./yr.	95	37	11	143
4	Locally cost-effective	Prop. 50 + $15 mil./yr.	188	37	11	236
5	Locally cost-effective	Prop. 50 + $40 mil./yr. (2005-2014); $10 mil./yr. (2015-2030)	185	35	16	236
6	The annual cost for projection 6 was not developed by CBDA because of uncertainty about how implementation costs would change as measure adoption rates approached 100%.					

Major Issues Facing Additional Urban Water Use Efficiency

Funding

Funds dedicated to water use efficiency have fallen below commitments made in 2000 through the CALFED Record of Decision that called for a state and federal investment of $1.5 billion to $2 billion during Stage 1 from 2000-2007. For example, by 2002, investments lagged projected expenditures by $4 million. By 2003, investments lagged projected expenditures by $235 million.

Through the CUWCC MOU, local agencies have committed to funding locally cost-effective BMPs. State and federal programs have also provided funding for the BMPs beyond the MOU level for actions that may not be locally cost effective. A consistent and broadly acceptable method to evaluate cost-effectiveness and water savings has been developed by the CUWCC. A publication describing cost effectiveness and spreadsheets that calculate cost effectiveness by BMP have both been created, and are posted on the Council's web site. A water savings model has also been created and is embedded into the Council's BMP Reporting database. The results are publicly viewable at www.bmp.cuwcc.org.

Additional research is needed into the problems of funding and implementing the water conservation programs. One approach to funding programs is a no-interest revolving loan program that could provide funds to urban water suppliers based on the avoided cost of new supply alternatives. Once the loan is repaid, all future savings will accrue to the supplier and its customers. One example of a no-interest loan program is the "Unconserved Water Using Air Conditioner Replacement Program" established by the city of Fresno. The program made customers with water using air conditioners, who paid a surcharge based on the estimated water use of the devices, eligible to replace them with new non-water using energy efficient units. It applied the surcharge paid by participating customers to loan repayment for the program. The customer surcharge will be eliminated when the no-interest loan is repaid.

This research should include innovative mechanisms similar to those used by performance based contractors in the energy field. One example is the Light Wash Program in which a company is working with California water agencies and utilities to offer combined energy and water conservation rebates of up to $450 per unit on a wide selection of high efficiency commercial clothes washers. The company offers rebates to multifamily and institutional common area laundry facilities, businesses with on-premise laundry, and coin laundry stores in 2003. The program is operated on a turnkey basis for participating water utilities and requires virtually no staff time. The only required contribution by participating water utilities is the rebate co-payment. Program participation is available to water utilities whose customers are also customers of three energy utilities. The program is being implemented with funding from California energy utility ratepayers under the auspices of the California Public Utilities Commission.

Grant programs often miss the opportunity to fund worthwhile projects in small and disadvantaged communities. It is often difficult for them to compete for limited grant funds, although their needs are often great.

Program Implementation

An expanding population, climatic uncertainties, contaminants, and legal and economic conditions likely will increase the pressure to improve the efficiency of water use in California. While the CUWCC Best Management Practices have provided an effective way for agencies to identify and implement locally cost effective urban water conservation programs, not all water suppliers have signed on to the agreement and not all of the signatories are fully implementing those practices.

There are a number of challenges faced by agencies when implementing urban water conservation programs. A recent study sponsored by California Urban Water Agencies identified a number of these implementation challenges for urban water conservation programs (See Table 22-5).

The CUWA sponsored study recommends collaborative action by agencies, further research, and continued State/federal support in addressing the implementation challenges. CUWA study concludes that the program should be as easy as possible for customers, its design should be simple, it should provide customers with guidance on water efficient fixtures, it should be coordinated with other agencies regarding permitting or potential funding, and emphasize a high level of customer service.

Data Collection

Easily retrievable, standardized and comprehensive baseline data about California urban water use are not available. Present information sources include annual Public Water System Survey (PWSS) reports to DWR, annual CUWCC BMP Reports submitted by MOU signatories, and Urban Water Management Plans that are updated every five years. Documentation and evaluation of the achievements attributable to water use efficiency projects and programs, vital elements of successful water use efficiency efforts, need to be improved. The quantification of benefits for many projects lacks the necessary level of scientific rigor. The basis for making such determinations and managing water efficiently is accurate water measurement, coupled with volumetric billing, complemented by ongoing accounting, monitoring and assessment.

The measurement of water use and associated information provided to the water user are essential to efficient water management. Documenting water savings related to the various programs rests on the ability to track water use. Most urban areas are metered, but several metropolitan areas, mostly in the Central Valley and Foothill regions, remain unmetered. DWR staff estimates that about 700,000 water users remain unmetered.

Both of these endeavors are necessary to gain an accurate understanding of the full cost, value, impact and direction of urban water use efficiency strategies.

Education and Motivation

Likewise, there is a need for information related to why Californians adopted water use efficiency practices and how those practices could be encouraged and continued. Also, there is need to determine how customers or water districts respond to financial incentives. Which technological changes should be pursued for short-term situations (during water shortages) compared to long-term, and which behavioral changes are most effective short and long term?

Innovation

Emerging water conservation technologies and techniques offer new opportunities to save water, but often field-testing and evaluations are needed before being promoted and fully adopted. Presently it takes too long to run pilot projects, conduct research, and provide the sound scientific data needed by agencies and consumers to adopt new behaviors or purchase new equipment.

Conservation Offset refers to the actions that urban water suppliers take where a developer, in order to obtain approval for a proposed project, must implement, or financially contribute to, actions that will save water at or above the demand level of the project. Developers have installed or paid for the retrofit installation of dual flush toilets, low flush toilets, high efficiency clothes washers, Xeriscape residential landscaping, water efficient landscaping on common area and street medians, ET irrigation controllers, artificial turf, use of recycled water for all large turf irrigation, hot water recirculation demand systems, pre-rinse spray valves, and even farm irrigation improvements. Offset programs in Cambria, on the California coast, have included farm irrigation improvements such as drip irrigation. Some water districts implementing an Offset program require the developer to implement actions that save two or more times the projected water demand for their projects. As a result, some communities with limited water supplies have been able

Table 22-5 Urban water conservation implementation challenges	
Program Type	**Implementation Challenges**
Residential indoor	Marketing; incentives; communication barriers
Residential outdoor	Persistence of water savings; follow-up visits; communication barriers
Public information	Difficult to quantify water savings; communication barriers; need to update information on a regular basis
Commercial, industrial and institutional	Lack of reliable savings estimates; lack of adequate in-house technical skills; resistance to changes in a process that works; communication barriers; low water costs make water conservation a low priority for some businesses
Large landscape	Incentives (the hand on the spigot may not pay the bill); persistence of water savings; communication barriers
Targeting public entities	Incentives (some public entities do not directly pay for the water),school's lack of funding inhibits participation
Plumbing code	Lack of coordinated effort to revise the standards
Water rates/efficiency pricing	High risk local political issue
Leak detection	High expense of leak detection; requirements for retrofit or rehabilitation

to permit some growth while reducing their net water needs. Water savings have been achieved using the Offset program in the city of San Luis Obispo (2 acre-feet of retrofit water savings required for each new acre foot of demand, a 2:1 Offset), Cambria (7-8% less water use per year), Ojai (3:1 Offset).

While an Offset program can be a useful part of a tool kit for water supplier's conservation actions, the concept has not been widely used despite its successes. However, the requirements for documenting a reliable water supply over a 20-year period created by Senate Bill 610 and Senate Bill 221 may create an incentive for developers to implement voluntary Offset programs in order to create new water supplies for their projects.

Recommendations to Achieve Additional Urban Water Use Efficiency

In addition to the BMPs, the following actions reflect some of the possible solutions to the issues raised in the previous section. A wide range of strategies will need to be employed to accomplish the actions including financial incentives; revisions in State and local codes and standards; and legislative initiatives. Most of these will be cooperative efforts, involving State, federal, and local agencies and stakeholders and California citizens.

1. The State should secure funding to support incentive programs, both implementation and data collection. Identify and establish priorities for future grant programs and other incentives. Provide ample opportunities for small districts, economically disadvantaged communities to benefit from WUE incentive programs.
2. Work with CUWCC and others to encourage and help local agencies and governments in fully developing, implementing and sustaining water conservation programs. Develop and implement rate structures that encourage water use efficiency. Help water customers perform leak detection and repair on a regular basis. Employ recycled water whenever feasible for landscape, industrial, and other approved uses. Encourage the plumbing of new construction for the use of non-potable water.
3. Consider how to irrigate landscapes efficiently, reduce urban runoff, improve fire safety, and mitigate "heat island effects" through landscape design, installation, management and maintenance practices such as grouping plants with similar water use requirements, irrigation scheduling, landscape audits, dedicated irrigation meters, weather driven timers, etc. The State should provide technical assistance to the California Urban Water Conservation Council and urban water suppliers to create "California Friendly Landscapes©," those that attain maximum water use efficiency by applying the minimum amount of water necessary to sustain them through the design, installation, management, and maintenance of landscape material. The State should support the recommendations of the AB 2717 Landscape Task Force convened in 2005 by the CUWCC. The Task Force will (1) make recommendations for improving the Model Landscape Ordinance, and (2) comment on additional matters related to landscape water use efficiency. Consider

use of graywater systems where conditions permit and cistern systems to capture storm water where appropriate.

4. Develop collaborative efforts to:
   - Work with builders, manufacturers and others to establish a "Water Star Homes" program for new and existing homes and performance standards for fixtures and appliances, reducing residential water use.
   - Retrofit remaining standard toilets with more efficient models, such as dual-flush toilets or 1.0 gallon-per-flush toilets.
   - Use hot-water-on-demand systems in new residential construction
   - Pursue best available technology and management practices in the commercial, industrial, and institutional sectors.
   - Retrofit standard urinals with more efficient models.
   - Encourage the formation of employee/management "Green Teams" in commercial, industrial and institutional customers to promote sustainable resource use.
   - Encourage dry cooling for power plants.
   - Provide comprehensive public information, education, training, and technical assistance programs to foster a strong environmental resource ethic with an emphasis on water use efficiency.
   - Coordinate with other resource management programs such as watershed management, urban runoff management,waste water treatment, and green waste reduction.

5. Consider data, research, and monitor needs to inform decisions on:
   - Support metering of all urban customers and bill by volume of use, submeter new multifamily residential construction.
   - Encourage development of incentives for use of submeters in large landscape irrigation.
   - Employ scientific methods to research, monitor, and evaluate existing and new water use efficiency technologies and management practices, including the positive and potentially negative effects of these practices and real world challenges to implementation.
   - Increase the emphasis on the science aspect of projects, especially monitoring and evaluation, in support of CALFED goals.
   - Work with State and federal grant recipients and others to obtain more useful and consistent data from funded projects and other activities, including the documentation of the sources of data and the methods of data collection.
   - Encourage comprehensive planning and implementation of water conservation activities at the local and regional level. Pursue and promote state or local policies, guidelines, ordinances, or regulations to affect positive change.
   - Encourage more signatories to the CUWCC Memorandum of Understanding and full participation by present signatories.
   - With the leadership of the CUWCC and participation of other stakeholders, standardize utility billing and reporting systems by customer type and units of measure and identify industrial water use customers by North American Industry Classification System (NAICS). Collect end-use data periodically. Coordination of water use reports and the use of a web-based format for reporting could also improve data collection and exchange. Support uniform water use reporting.
   - Gain more information through surveys and other methods to better understand how Californians use water and how to persuade them to adopt more efficient practices and behaviors. Establish a goal for per capita water use in California.

Box 22-3 Demand Hardening

Most water use efficiency programs rely on plumbing and appliance retrofits and changes in the consumer's water use that can take place on a consistent, predictable basis. Once most of these retrofits have been completed, some worry that their ability to further reduce water use during dry years will be limited. This phenomenon is known as "demand hardening". Districts and customers that have participated actively in water conservation programs fear that across-the-board cuts will affect them disproportionately. However, consumers will still respond behaviorally in drought times, and this additional water savings from the drought response can be measured using daily production records. Public education has proven effective in rallying support for short-term additional water conservation measures.

6. Develop community based social marketing surveys and strategies for conservation activities to foster water use efficiency, with the participation of the water industry, environmental interests, and the business communities. Identify and overcome barriers, communicate the benefits, provide incentives, and gain commitment from all involved.
7. Explore and identify innovative technologies and techniques to improve water use efficiency and develop new BMPs to correspond with new information. Fast track pilot projects, demonstrations, and model programs exploring state-of-the-art, water-saving technologies and procedures and publicize results widely.
8. State should prepare guidelines to assist water districts who are interested in implementing the Conservation Offset.
9. Some innovative Offset techniques need to be developed for urban landscaping savings.
10. State should encourage building trade associations promote the Offset concept.

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